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MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

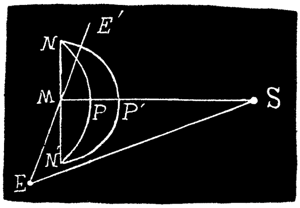
15. Proposed by SAMUEL HART WRIGHT, M. D., M. A., Ph. D., Penn Yan, Yates County, New York.

Required the illuminated area of the Moon's disc when $\frac{2}{3}$ through its first quarter, or 60°of longitude east of the Sun, the Earth and Moon being at their mean distances.

Solution by F. P. MATZ, M. Sc.; Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Represent the centers of the sun, earth, and moon, by S, E, and M, respectively; also, represent the *mean* distances of the moon and sun from the earth, respectively, by $EM=d=1$, and $SE=nd=395.40$. Let $\angle MES=\Psi=60^\circ$; $\angle SME'=\phi$; and $MS=d\sqrt{(n^2+1-2n\cos\Psi)},=d\sqrt{(n^2-n+1)}=394.90$; then, by well-known principles of Trigonometry, we deduce

$$\phi=\sin^{-1}\left(\frac{n\sin\Psi}{\sqrt{[(n-1)^2+2n(1-\cos\Psi)]}}\right),=60^\circ7'33''.223.$$



Put $\mathbf{A},=\frac{1}{2}$, the apparent area of the semi-circle $NP'N'$ at a unit's distance, $\mathbf{A}'$ =the apparent area of this semi-circle at a distance $EM=d$; then, since the apparent *diameter* of the moon varies inversely as the distance and the apparent *area* of the moon's disc varies as the square of the distance, we we have $\mathbf{A}'=\mathbf{A}\,/\,d^2$. The *phase*, or illuminated area, $NP'N'PN$ at a distance $EM=d$, we represent by $\mathbf{P}$; and the apparent area of the semi-ellipse NPN' at a distance $EM=d$, by $\mathbf{E}$; then, according to obvious principles and deductions already made, we obtain the formula,

$$\mathbf{P}=\mathbf{A}'-\mathbf{E}=\mathbf{A}'(1-\cos\phi)=\mathbf{A}(1-\cos\phi)\,/\,d^2,$$

$$=\frac{\mathbf{A}}{d^2}\left[1-\sqrt{\left(\frac{(n-1)^2-n(1-\cos\Psi)[n(1+\cos\Psi)-2]}{(n-1)^2+2n(1-\cos\Psi)}\right)}\right]$$

$=\mathbf{A}(1-.4981517)\,/\,d^2=\frac{1}{2}$of.5018483=.2509241+; that is, about *one-forth of the apparent disc* of the moon is then illuminated.

NOTE.—An easy trigonometrical operation gives the formula,

$$\phi=\pi-\left\{\Psi+\tan^{-1}\left[\left(\frac{n-1}{n+1}\right)\cot\tfrac{1}{2}\Psi\right]\right\}$$

$$=\pi-\left\{\Psi+\tan^{-1}\left[\left(\frac{n-1}{n+1}\right)\sqrt{\left(\frac{1+\cos\Psi}{1-\cos\Psi}\right)}\right]\right\},$$

$$=\pi-[\tfrac{1}{3}\pi+\tan^{-1}(\tfrac{986}{991}\sqrt{3})]=60^\circ 7' 33''.223.$$

It must be observed that a reversed crescent of the same size is illuminated when the "Waning Moon" is two-thirds through her *last* quarter.

PROBLEMS.

28. Proposed by "IAGO"-(The late DR. JAMES MATTESON, DeKalb Center, Illinois.)

If 9 gentlemen, or 15 ladies, will eat 17 apples in 5 hours, and 15 gentlemen and 15 ladies can eat 47 apples of a similar size in 12 hours, the apples growing uniformly; how many boys will eat up 360 apples in 60 hours, admitting that 120 boys can eat the same number as 18 gentlemen and 26 ladies? *F. P. Matz.*

29. Proposed by ALEXANDER MACFARLANE, M. A., D. Sc., LL.D., Cornell University, Ithaca. New York.

A rectangular room has the four walls, the floor, and the ceiling covered with mirrors; a candle is placed inside the room: find a formula which will express all the images.

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EDITORIALS.

Professor Milton L. Comstock, Professor of Mathematics, Knox College, Galesburg, Illinois, says, I have read the MONTHLY from the beginning and I am willing to bear testimony as to its excellence.

In future numbers of the MONTHLY, some valuable contributions on important Mathematical subjects may be looked for from Dr. G. A. Miller, of the University of Michigan, and Dr. W. B. Smith of the Tulane University of Louisiana.

Professor F. P. Matz, of the Department of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland, has just received official notice of his unanimous election as member of the London Mathematical Society, having been proposed for membership, by Professor J. J. Sylvester. Dr. Matz was also elected member of the American Mathematical Society at its meeting in February, having been proposed for election by Professor William W. Johnson, of the United States Naval Academy and endorsed by Professor Simon Newcomb. We congratulate Dr. Matz on these merited recognitions.

Professor J. E. Oliver, Professor of Mathematics in Cornell University died, on the 27th of March, 1895, after an illness of ten weeks.